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Publication date:
2020

Document Version
Early version, also known as pre-print

Link to publication in Tilburg University Research Portal

Citation for published version (APA):
Argenton, C., & Wang, X. (2020). *Litigation and Settlement under Loss Aversion*. (CentER Discussion Paper; Vol. 2020-008). CentER, Center for Economic Research.

Discussion paper

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March 2020

TILEC Discussion Paper No. 2020-002
CentER Discussion Paper No. 2020-008

ISSN 2213-9532
ISSN 2213-9419
http://ssrn.com/abstract=3556480

Litigation and settlement under loss aversion

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Jan.30, 2020

Abstract

In this paper, we investigate how loss aversion affects people's behavior in civil litigation. We find that a loss-averse plaintiff demands a higher offer for small claims to maintain her threat to proceed to trial compared to a loss-neutral plaintiff. For larger claims, a loss-averse plaintiff demands a lower offer to increase the settlement probability as loss pains her extra in trial. We also investigate how various policies affect loss-averse litigants' settlement decisions. Only a reduction in the asymmetry of information about trial odds uniformly leads to higher settlement rates.

keywords: settlement, loss aversion, asymmetric information

JEL codes: D82, K41

1 Introduction

Private litigation is one of the most important aspects of a modern legal system. In (the 12-month period ending in) 2016, about 20.3 million new civil cases were filed in State courts in the US, to which one must add 274,555 new civil cases filed in US district courts.[1] However, most cases do not go to trial: they are dropped, resolved by motions, or settled in some way. Data on US State courts show that over 96 percent of civil cases do not go to trial (Ostrom, Kauder, and LaFountain, 2001). Similarly, data on federal courts demonstrate that, for fiscal year 2016, almost 99 percent of civil cases were resolved without trial.[2] Still, in this and other jurisdictions, given the high costs associated with the judicial system, public authorities actively try to encourage alternative modes of dispute resolution, other than trial.[3] Fostering settlements is typically part of such a strategy, but it requires understanding how parties to a dispute behave in the first place.

1. Data for State courts are taken from the State Court Caseload 2016, produced by the National Center for State Courts. See <http://www.courtstatistics.org/~/media/Microsites/Files/CSP/National-Overview-2016/SCCD_2016.ashx> (consulted on September 3, 2018). Data for US courts are taken from the Federal Judicial Caseload Statistics, 2016, produced by the Administrative Office of the US Courts. See <http://www.uscourts.gov/sites/default/files/data_tables/fjcs_jci_0331.2016.pdf>(consulted on September 3, 2018). For State courts, cases classified as having either a civil or a domestic relations nature were both taken up.

2. Federal Judicial Caseload Statistics, 2016, produced by the Administrative Office of the US Courts. See <http://www.uscourts.gov/sites/default/files/data_tables/fjcs_c4_0331.2016.pdf> (consulted on September 3, 2018).

3. For instance, the US Department of Justice has set up an Office of Dispute Resolution whose mission is to promote the effective use of alternative modes of dispute resolution throughout the Department but also in litigation.

There is a large literature on the behavior of private litigants but it takes for granted that litigants behave as rational expected utility maximizers (and, more often than not, as expected wealth maximizers). The economic theories of litigation started with Landes (1971) and Gould (1973) that focused on the divergence in expectations about trial outcomes between the plaintiff and the defendant.[4] Subsequently, scholars started to use asymmetric information to model litigation and settlement behavior. In a typical tort litigation setting, the plaintiff may indeed have private information about the damages she has suffered while the defendant may have private information about his liability for the accident. Ramseyer and Nakazato (1989), Farber and White (1991), Osborne(1999), Waldfogel (1998) and Sieg (2000) all provide empirical evidence for the existence and the importance of asymmetric information in various litigation environments. P'ng (1983) and Reinganum and Wilde (1986) use a signaling model where the informed party moves first by making a settlement offer. Bebchuk (1984) adopted a screening set-up where the uninformed party makes a settlement offer to the informed one. That model is particularly adapted to the case where a one-time victim sues a repeated or well-informed defendant.[5] The main prediction of that model, that cases reaching trial should disproportionately be made up of cases favorable to the defendant, is borne out in many contexts.[6] However, some of the predictions of that model, for instance, the ones related to legal fee-shifting, are not consistent with the empirical evidence (see section 4 for further discussion).

One problem we see is that the decision-theoretic foundations of existing models are traditional. They do not acknowledge some of the well-established regularities that led the profession to question the empirical relevance of standard expected utility maximization, such as loss aversion. Starting with Kahneman and Tversky's prospect theory (Kahneman and Tversky 1979), numerous studies have established that decision makers evaluate options based on gains and losses in comparison with a reference point. The evaluation is asymmetric: losses loom larger than same-sized gains. Loss aversion is observed in many real-world contexts, as well as laboratory or field experiments. It has proven to be a powerful explaining tool. For instance, combining loss aversion and myopia, Benatzi and Thaler (1993) provided an explanation to the equity premium puzzle. Camerer et al. (1997) used loss aversion to make sense of cab drivers' decisions on their daily working hours. Genesove and Mayer (2001) found that it explained the behavior of sellers on the housing market in Boston in the 1990s. Several studies (Thaler 1980, Knetsch and Sinden 1984, and Thaler and Johnson 1990) used loss aversion to explain the fact that people place higher value on objects which they already have compared to those they do not have (the endowment effect). Loss aversion also helps explain the sunk cost fallacy and the escalation of commitment (Arkes and Bloomer 1985). It has an important impact on legal theories as well. For example, Zamir and Ritov (2010) used loss aversion to explain the popularity of contingent-fee arrangements with lawyers, which cost their clients two

4. See also Posner (1973), Shavell (1982) and Vasserman and Yildiz (2019).

5. Spier (1992) extended the framework of Bebchuk (1984) by allowing multiple periods of bargaining to explain the "U-shaped" time pattern of settlement. Schweizer (1989), Spier (1994) and Klerman et al.(2018) explored litigation games with two-sided asymmetric information.

6. For the case of medical malpractice in the US, see the review by Peters (2009), which shows that cases with objective evidence of negligent or deficient care are more likely to settle.

or three times more than an hourly-rate or fixed-amount arrangement. Wistrich and Rachlinski (2012) found that loss aversion and the sunk-cost fallacy led experienced lawyers to prolong litigation, which hurts their clients. In this paper, we study how loss aversion affects litigants' choices about settlement in private litigation.

Given how pervasive loss aversion is, it is important to understand how litigants' behavior is affected by it. In this paper, we try to answer this question from a theoretical perspective. Specifically, we are interested in how loss aversion affects litigants' decisions such as filing a lawsuit and choosing a settlement offer. We show that loss aversion significantly affects a plaintiff's decisions. In particular, contrary to what first intuition may suggest, loss-averse plaintiffs are not uniformly likely to settle more often, or for less, than loss-neutral litigants.

We base our model on Bebchuk's (1984): an uninformed plaintiff makes a settlement offer to an informed defendant. The settlement offer has the screening function: a defendant with a weaker case will accept the offer while a stronger defendant will prefer trial. If the offer is rejected, we assume that the plaintiff can drop the suit and save litigation costs. In this case, the plaintiff faces a credibility constraint: her offer is credible only if she can maintain her threat to proceed to trial following rejection (Nalebuff, 1987). Although it is intuitive that loss aversion makes for a weaker plaintiff who settles for less, this only happens when the stake is high enough. The need to remain credible induces a loss-averse plaintiff to ask *for more* when stakes are low. The intuition for this result is as follows: a loss-averse plaintiff has to further lower the offer amount to keep the credibility constraint satisfied because trial brings more disutility to her than to a loss-neutral plaintiff.

We discuss changes to the environment or policy rules (level and allocation of trial costs, underlying uncertainty, in-court settlement regime). As one would expect, the effects on settlement rates and litigation costs differ depending on whether the credibility constraint is binding or not. Only a reduction in the asymmetry of information can uniformly lead to a decrease in trial costs.

Section 2 introduces our baseline model and the main results. Section 3 discusses comparative statics regarding litigation costs and the distribution of the defendant's types. Section 4 discusses fee-shifting rules and an in-court settlement system. Section 5 concludes.

2 Baseline Model

2.1 Setup

In this section, we introduce our litigation model, featuring asymmetric information and a loss-averse plaintiff. We assume that there are two players, the plaintiff and the defendant. For convenience only, in what follows we take the plaintiff to be female and the defendant male. The plaintiff sues the defendant for compensation W, which is assumed to be fixed and commonly known to both players at the beginning of the game.[7] If they proceed to the trial stage, the plaintiff will pay fixed litigation costs

7. In practice, certainly in liability cases, the quantum of harm is not known with certainty and its assessment is part of the dispute.

$C_p \geqslant 0$ and the defendant will pay $C_d \geqslant 0$. Those represent the direct and opportunity costs associated with introducing, supporting or defending a formal lawsuit. If the two parties manage to work out a settlement before trial, they will save litigation costs C_p and C_d. If the plaintiff does not drop the suit after settlement fails, trial will follow. A more detailed description of the timing comes later in this section. For the time being, we introduce the key assumptions of the model.

Asymmetric information In a civil dispute, the defendant often has more information regarding the existence of liability (for instance, whether negligence could be proven in court). We assumed the defendant to have private information about the strength of his case. To be specific, he knows his probability of losing in court, which is randomly and privately drawn at the beginning of the game and is denoted by $p \in [0, 1]$. The plaintiff, on the other hand, only knows the distribution of p, represented by a p.d.f. $f(\cdot)$ and a corresponding c.d.f. $F(\cdot)$. Based on this limited information, she makes a unique settlement offer to the defendant.[8]

Loss-averse plaintiff The plaintiff's preferences are represented by a reference-dependent utility function with loss aversion. We use Kahneman and Tversky's value function of income w with respect to a fixed reference point, o:

$$u(w|o) = \begin{cases} w - o & \text{if } w \geqslant o \\ \mu(w - o) & \text{if } w < o \end{cases} \tag{1}$$

In the gain domain, the utility is the difference between the actual income w and the reference income o. In the loss domain, the difference is multiplied by the loss aversion coefficient, μ ($\mu \geqslant 1$). This coefficient describes the importance of loss aversion in the plaintiff's preferences: for $\mu = 1$, the plaintiff is a standard expected utility maximizer; for $\mu > 1$, losses loom larger in her assessment of uncertain prospects, and the more so, the higher μ. In what follows, we assume o to be equal zero. That is, we assume that the reference point is the status quo prior to starting litigation. It is assumed exogenous and constant during the litigation period. Although the specification of an exogenous reference point is somewhat arbitrary as part of a theoretical exercise, we note that the use of this reference point (as opposed to, say, the situation before the faulty action taken by the defendant) is supported by some experimental evidence (Zamir and Ritov, 2012).[9]

We assume that utility is linear in w. That is, we assume that the plaintiff is risk-neutral in the gain and loss domains, respectively, and isolate the effects of loss aversion. In practice, individuals are likely to exhibit both risk and loss aversion. For simplicity, we circumvent the differences in risk attitudes and focus exclusively on the fact that losses loom larger than gains. In the conclusion, we elaborate on the changes which risk aversion would bring to our analysis.

8. One could of course consider the contract-theoretical case where the plaintiff attempts to screen defendants by offering them to choose their preferred option in a menu of settlement amounts and continuation probabilities, so that they truthfully reveal their type. It is however hard to think of a situation where the plaintiff could *commit* herself to proceed to trial with a given probability. On the contrary, we believe that the plaintiff can always choose to drop the lawsuit after her offer has been rejected and that is what we model.

9. If the plaintiff were basing her utility on the situation before the event that caused litigation, under compensatory damages she would experience utility only in the loss domain (for, in the best case, she can only hope to be fully compensated for the harm suffered) and loss aversion would therefore not play any role.

Whether the defendant also exhibits loss aversion (which may be an empirical issue if, for instance, it is a corporation or an insurance company in an individual tort case) is immaterial to our analysis. Winning at trial, losing or accepting the settlement offer, the defendant always finds himself in the loss domain. Every payment he makes would be multiplied by coefficient $-\mu$ in his utility function, so the level of μ does not matter for his decisions as long as it is non-zero.

Timing and choices The timing of the game is given in the following figure:

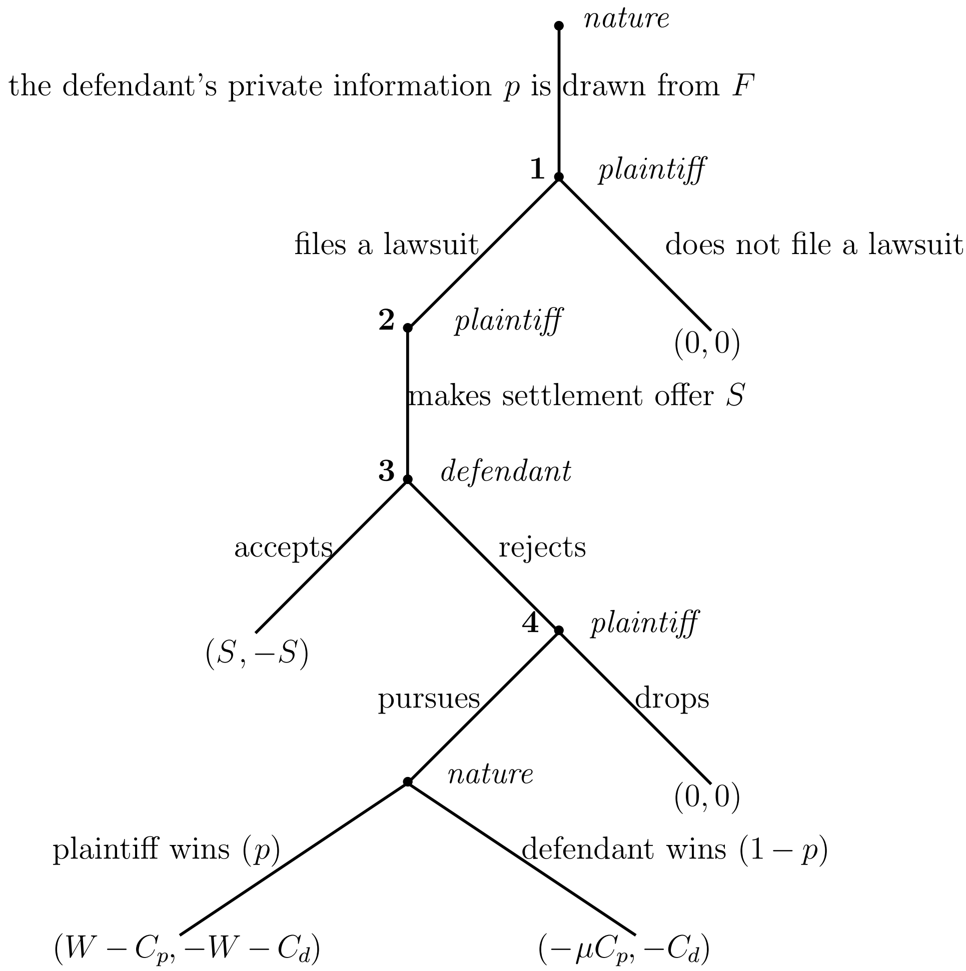

Figure 1. Timing of the litigation game

Compared to Bebchuk (1984), one noticeable feature of our game is the following: if the settlement offer is rejected, then the plaintiff has the chance to drop the suit. In that case, she does not have to pay litigation costs C_p but receives nothing from the defendant. It means that in the pre-trial settlement phase of the game, she has to look at the credibility of her implicit threat to actually proceed with trial in case her settlement offer is rejected, a point first made by Nalebuff (1987).

We solve this game of incomplete information for perfect Bayesian equilibria. Before going into the actual analysis, we survey the key decisions to be made by the litigants, according to backward induction.

Dropping the suit In stage 4, the plaintiff decides whether to drop the suit or not given that her offer has been rejected. Depending on the amount of the rejected offer, she updates her belief about the defendant's type p. Then, she makes her decision by comparing the expected utility of trial (formally defined later) and that of dropping the suit, which is assumed to be zero. For convenience, we assume that the plaintiff will pursue the lawsuit if she is indifferent between dropping it and pursuing it.

Accepting the offer In stage 3, the defendant decides whether to accept the offer or not. The decision will depend on whether a trial is likely to follow or not and, in case it is, on the expected trial costs compared to those of accepting the settlement offer.

Making an offer In stage 2, anticipating the defendant's acceptance/rejection behavior and her own decisions regarding pursuing the lawsuit in case her offer is rejected, the plaintiff chooses a settlement amount that maximizes her expected utility. At this stage she faces a credibility constraint: an offer that is too generous might be rejected only by the more serious defendant types, which would prevent her from rationally continuing with litigation after rejection.

Bringing the lawsuit If the plaintiff always gets negative utility from trial, she will drop the suit in stage 4. She thus gets zero utility from bringing the lawsuit and is indifferent between bringing it and not. For convenience, we assume that she will not bring the lawsuit in the first place. (It is also likely that in reality, merely filing a lawsuit already comes at a cost.)

2.2 Formal Solution

In an equilibrium $\{L, S^*, r(S,p), b^r(S), d^r(S)\}$, $L \in \{0,1\}$ is the plaintiff's decision about whether to bring the lawsuit or not. S^* is the equilibrium offer made by the plaintiff. $r(S,\,p)$ is the probability that a type p defendant rejects offer S, where $r \in [0,\,1]$. $b^r(S) \subset [0,\,1]$ characterizes the plaintiff's belief about the support of the distribution of the defendant's types at trial and $d^r(S) \in [0,\,1]$ characterizes the probability that the plaintiff dropping the suit if offer S is rejected. We start by showing that an offer with $d^r(S) = 1$ (i.e. the plaintiff drops the suit with probability 1 following rejection) is always rejected in equilibrium.

Lemma 1. *In a perfect Bayesian equilibrium, if the plaintiff drops the suit for sure after rejection of offer $S\,(d^r(S) = 1)$, then S is rejected with probability 1 by all defendant types.*

Proof. *see the appendix.* □

An immediate consequence is that, if an equilibrium involves such an offer on the equilibrium path ($d^r(S^*) = 1$), then the plaintiff's payoff from bringing the lawsuit is zero. By assumption, the plaintiff then does not bring it. From now on, we focus on equilibria where a lawsuit is introduced.

Next, we show that the defendant's equilibrium choice exhibits a cut-off property.

Lemma 2. *In a perfect Bayesian equilibrium, for an offer S with $d^r(S) \in [0,1)$, if a type $\tilde{p}$ defendant weakly prefers rejecting to accepting, then (i) $\tilde{p}$ strictly prefers rejecting $\tilde{S} > S$ and (ii) a defendant with $p < \tilde{p}$ strictly prefers rejecting S to accepting it.*

Proof. *see the appendix.* □

Notice that sequential rationality requires that Lemma 1 and Lemma 2 hold for equilibrium offer S^* as well as any other offer S off the equilibrium path. As we assumed that the plaintiff pursues the trial when she is indifferent, we have either $d^r(S)=1$ or $d^r(S)=0$ in any sub-game after the plaintiff makes her offer, denoted by S.

One can restrict the range of the equilibrium offer S^* to $[C_d, W+C_d]$ without loss of generality. $S^*=C_d$ is the highest offer that is accepted with probability 1 by all defendant types. In equilibrium any choice $S^*<C_d$ is strictly dominated by $S^*=C_d$ because the latter brings the plaintiff more and is also accepted for sure. $S^*=W+C_d$ is the lowest offer rejected with probability 1 by all defendant types. Any choice $S^*>W+C_d$ leads to the same outcome as $S^*=W+C_d$.[10]

Furthermore, directly from Lemma 2, for an offer within the range $[C_d, W+C_d]$ with $d^r(S)=0$, the defendant's equilibrium choice is characterized by a cut-off type $p(S)$:

$$p(S) \;=\; \frac{S-C_d}{W} \tag{2}$$

For the defendant with type p, he will reject S for sure if $p<p(S)$; if $p>p(S)$, he will accept S for sure. Moreover, we have $p'(S)=1/W>0$: if the plaintiff increases the offer amount, the probability of rejection will increase as defendants with weaker cases will choose to reject.

From the plaintiff's perspective, the probability of trial is therefore $F(p(S))$ and her expected utility is (with subscript p standing for plaintiff):

$$U_p(S) \;=\; [1-F(p(S))]\,S+\int_0^{p(S)}[p\,W-C_p-(\mu-1)\,(1-p)\,C_p]\,f(p)d\,p \tag{3}$$

$pW-C_p$ is the expected income from trial. Loss aversion introduces an asymmetry between settlement and trial in the plaintiff's choice: settlement is a sure gain while trial might lead to a loss (given the existence of trial costs). Faced with a type p defendant, the plaintiff loses with probability $(1-p)$ and the loss C_p is amplified by loss aversion. The solution to the first-order condition, S^{foc}, is given by:

$$\begin{aligned} 1-F(p(S^{foc})) \;=\;& f(p(S^{foc}))\,p'(S^{foc})\,(C_p+C_d)\\ &+(\mu-1)\,f(p(S^{foc}))\,p'(S^{foc})\,(1-p(S^{foc}))\,C_p \end{aligned} \tag{4}$$

Rewriting the above using $p'(S)=1/W$, we have:

$$\frac{1-F(p(S^{foc}))}{f(p(S^{foc}))} \;=\; \frac{(C_p+C_d)}{W}+(\mu-1)\,(1-p(S^{foc}))\,\frac{C_p}{W} \tag{5}$$

The right-hand side of the first-order condition is decreasing in $p(S)$. For it to uniquely pin down an interior solution $p(S^{foc})$ and thus S^{foc}, we need the following assumptions on the distribution of p:

10. Thus, if there are equilibria in which offer S^* is rejected for sure and P drops the lawsuit, there are also equilibria in which P makes an even higher offer, but all those equilibria are outcome-equivalent: by our assumptions, the lawsuit is not introduced in the first place.

Assumptions *A*: For the p.d.f. $f(\cdot)$ and the corresponding c.d.f. $F(\cdot)$, we have that:

1. $\dfrac{1}{f(0)} > \dfrac{\mu C_p + C_d}{W}$;
2. $\dfrac{f(p)}{1-F(p)}$ is increasing in p;
3. The concavity of $\frac{f(p)}{1-F(p)}$ does not change in [0,1]: $\left(\frac{\partial^2\left(\frac{f(p)}{1-F(p)}\right)}{\partial p^2}\right)$ has a constant sign for $p \in [0,1]$.

The first assumption guarantees that the marginal benefit of asking for more is high enough at $p(S)=0$, ruling out the corner solution $S=C_d$. Any distribution with a thin left tail satisfies it. Along with the second assumption, which is the standard monotone hazard rate property, it guarantees that an interior solution exists. The third assumption is about the curvature of the hazard rate and guarantees uniqueness. Log-concave distributions satisfy the second and the third assumptions, and most (truncations of) common distributions exhibit the third property.

Proposition 1. *Under assumptions A, the first-order condition* (5) *has a unique solution in* $p(S)$ *as well as in* S*.*

Proof. see the appendix. □

In first-order condition (4), the left-hand side is the marginal benefit of further increasing S. If the plaintiff increases the offer amount, she will extract more from defendant types $[p(S), 1]$. If the offer is accepted, the plaintiff's payoff is marginally increased by 1. The right-hand side denotes the marginal cost of increasing S. For a marginally higher offer, the marginal defendant(with type $p(S)$), will shift from accepting to rejecting. The plaintiff bears the full costs of this shift, which are the litigation costs $C_p + C_d$ multiplied by the intensity of the marginal shift. This trade-off is well-known since Bebchuk (1984). The second term on the right-hand side is new and results from loss aversion: against the marginal type $p(S)$, the plaintiff's losing probability is $(1-p(S))$, which costs her $(\mu-1)\,C_p$ in addition.

The above only applies to credible offers with $d^r(S)=0$. For this condition to hold, the trial stage utility must be non-negative. With the cut-off property of defendant's rejection choice, the plaintiff's expected trial stage utility is defined as below:

$$U_p^{trial}(S) \;=\; \mathbb{E}[p|p<p(S)]\,W - C_p - (\mu-1)\,(1-\mathbb{E}\,[p|p<p(S)])\,C_p$$

where $\mathbb{E}$ denotes the (conditional) mathematical expectation. Thus, the plaintiff's objective in Stage 2 becomes[11]:

$$\max_S U_p(S) \;\; s.t.\, U_p^{trial}(S) \geq 0$$

11. It means that in calculating plaintiff's utility of bringing the lawsuit, we assume that W is high enough such that trial is profitable for the plaintiff against the average defendant. If $U_p^{trial}(S) < 0$ for any S, the plaintiff does not bring the lawsuit as we assumed.

$U_p^{trial}(S)$ is the expected utility at trial stage. It is increasing in S over $[C_d, W+C_d]$: when the plaintiff increases the offer amount, the expected winning probability $\mathbb{E}[p|p<p(S)]$ becomes higher as the marginal type $p(S)$ becomes higher. Demanding more in the settlement, the plaintiff pushes weaker defendant types to trial, which means that she faces a more favorable pool of defendants in court. Therefore, the credibility constraint puts a lower bound on the settlement offer. The lower bound, denoted by $\underline{S}$, is the unique solution to the following equation:

$$U_p^{trial}(\underline{S}) = \mathbb{E}\left[p|p<p(\underline{S})\right]W - C_p - (\mu-1)\left(1-\mathbb{E}\left[p|p<p(\underline{S})\right]\right)C_p = 0 \tag{6}$$

The optimal settlement offer S^* is therefore given by:

$$S^* = \max\left(S^{foc}, \underline{S}\right) \tag{7}$$

2.3 Comparison with a traditional plaintiff

We now compare a loss-averse plaintiff's choices (S^* and $d^r(S)$) with those of a loss-neutral plaintiff $(\mu=1)$. We use subscript tp to denote such a 'traditional plaintiff'. Her objective is (assuming that bringing the lawsuit is profitable):

$$\begin{aligned}\max_S U_{tp}(S) &= \int_0^{p(S)} (pW - C_p) f(p) dp + (1-F(p(S)))S \\ s.t.\, U_{tp}^{trial}(S) &= \int_0^{p(S)} (pW - C_p) \frac{f(p)}{F(p(S))} dp \geqslant 0\end{aligned}$$

This is a similar constrained maximization problem: the plaintiff chooses a settlement offer that maximizes her expected utility given that her trial stage utility is non-negative if this offer is rejected. Similar to (5) and (6), we can solve for S_{tp}^{foc} by (5′) and $\underline{S_{tp}}$ by (6′):

$$1 - F(p(S_{tp}^{foc})) = f(p(S_{tp}^{foc}))\, p'(S_{tp}^{foc})\, (C_p + C_d) \tag{5′}$$

$$U_{tp}^{trial}(\underline{S_{tp}}) = 0 \;\Rightarrow\; E\left[p|p<p(\underline{S_{tp}})\right]W - C_p = 0 \tag{6′}$$

The solution is:

$$S_{tp}^* = \max\left(S_{tp}^{foc}, \underline{S_{tp}}\right) \tag{7′}$$

Comparing the settlement offers (S^* and S_{tp}^*) and the probabilities of trial ($F(p(S^*))$ and $F(p(S_{tp}^*))$), we find that the result depends on the claim W. We have the following proposition:

Proposition 2. *Compared with a traditional plaintiff, there exist unique values* $\underline{W_{tp}}$, $\underline{W}$ *and* $\tilde{W}$ ($\underline{W_{tp}} < \underline{W} < \tilde{W}$) *such that*

1. *For small claims* ($\underline{W_{tp}} \leqslant W < \underline{W}$)*, a loss-averse plaintiff does not file a lawsuit while a traditional plaintiff does.*
2. *For big claims* ($W \geqslant \tilde{W}$) *1) a loss-averse plaintiff demands a smaller settlement; 2) the probability of trial is lower; 3) total expected litigation costs are lower.*

3. For medium claims ($\underline{W} \leqslant W < \tilde{W}$), 1) a loss-averse plaintiff demands a higher settlement offer to make her threat to litigate credible; 2) the probability of trial is higher; 3) total expected litigation costs are higher.

Proof. *see the appendix.* □

The three critical values for W are defined as follows:

$$\underline{W_{tp}} = \frac{C_p}{\mathbb{E}[p]}$$

$\underline{W_{tp}}$ is the minimum of compensation level which incentivizes the traditional plaintiff to introduce the lawsuit. $\underline{W}$ is the minimum of compensation level which incentivizes the loss-averse plaintiff to introduce the lawsuit:

$$\underline{W} = (1 + (\mu - 1)(1 - \mathbb{E}[p]))\frac{C_p}{\mathbb{E}[p]}.$$

$\tilde{W}$ is implicitly defined as:

$$\underline{S}(\tilde{W}) = S_{tp}^{foc}(\tilde{W})$$

It is the compensation level at which the loss-averse plaintiff and the traditional plaintiff choose the same settlement offer. The existence and uniqueness of $\tilde{W}$ is established in the proof of Proposition 2 (see the appendix).

For the plaintiff there are two scenarios that affect her settlement offer. First, the offer optimizes her expected utility at the moment that the offer is made. As the plaintiff becomes (more) loss averse, the utility cost of losing in court becomes higher. To avoid this increased utility cost, she reduces the offer amount to increase the probability of acceptance. The second scenario is that after the settlement offer is rejected, the plaintiff's expected utility from trial is negative. It is not credible for her to proceed to trial and it implies that the offer is rejected by all defendant types. Increasing the amount, her offer is rejected by defendant types who have higher probability of losing in court, thus increasing the expected value from trial. For the offer to be credible, the expected value must be at least zero. A (more) loss-averse plaintiff counts the utility cost of losing in court more and needs a higher offer (i.e. a weaker pool of defendants who reject) to maintain a credible threat to proceed to trial. Depending on which scenario we are in, a (more) loss averse plaintiff can make a higher or lower settlement offer. For intermediate damage claims we are in the second scenario: it is optimal to file a lawsuit and the credibility constraint is binding. For smaller damage claims, the plaintiff does not file the lawsuit. For higher claims,the first scenario is more likely.

One might have thought that loss aversion makes for weaker plaintiffs who sue less often and, when they do, always settle for less. We show in Proposition 2 that the need to remain credible induces loss-averse plaintiffs to ask for more than loss-neutral plaintiffs when stakes are of medium size. That is because, under loss aversion it becomes harder to settle intermediate claims than big claims and total litigation costs go up in that case. An interesting, testable implication is that the presence of loss aversion will shift the composition of lawsuits *that proceed to trial* away from small and large stakes, and towards intermediate stakes, diminishing the variance of judgments.

2.4 A numerical example

The following figures give a numerical example of the probabilities of trial $F(p(S^*))$ $(F(p(S^*_{tp})))$, and settlement offers $S^*(S^*_{tp})$ under different claims W when p follows a truncated normal distribution on $[0,1]$.[12]

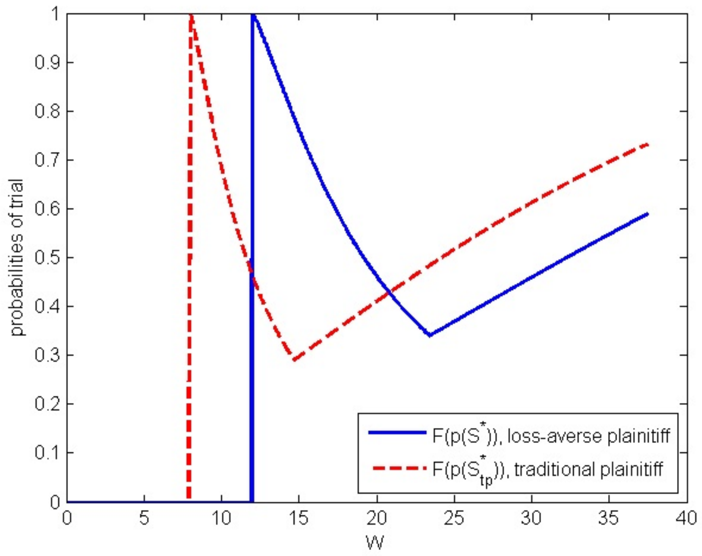

Figure 2. Probabilities of trial for different plaintiffs ($\mu = 2, C_p = 4, C_d = 2$).

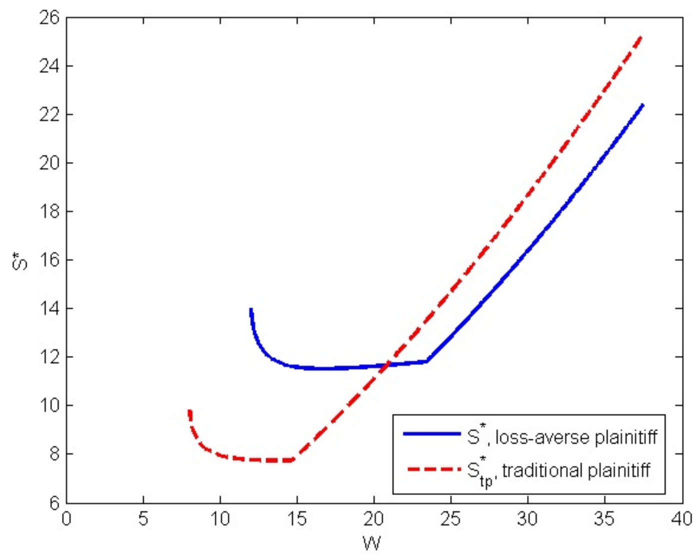

Figure 3. Settlement offers from different plaintiffs ($\mu = 2, C_p = 4, C_d = 2$)

12. The untruncated distribution has mean 0.5 and standard deviation 0.2. We use this distribution for all following numerical examples unless specified otherwise.

The results from Proposition 2 are clear from the figures. $\widetilde{W}_p$ ($\widetilde{W_{tp}}$) features a kink in the $S^*(W)$ ($S^*_{tp}(W)$) curve. For smaller W, the optimal settlement offer is determined by the credibility constraint that trial stage utility should be non-negative; for larger W, the optimal offer is determined by the first-order condition. For $\underline{W} \leqslant W < \tilde{W}$, the loss-averse plaintiff demands a higher settlement to make sure that she will not drop the case if her offer is rejected. For $W \geqslant \tilde{W}$, the loss-averse plaintiff demands a lower settlement offer to increase the probability of settlement. Both results come from the fact that the loss-averse plaintiff suffers additional utility loss when she loses in trial.

For $W < \underline{W_{tp}}$, neither a traditional plaintiff nor a loss-averse plaintiff finds it profitable to bring a lawsuit. For $\underline{W_{tp}} \leqslant W < \underline{W}$, a traditional plaintiff brings a lawsuit whereas a loss-averse plaintiff does not. Again, the intuition is that it is harder for a loss-averse plaintiff to *profitably* go to trial: she endures additional utility loss if she loses in trial compared to a traditional plaintiff. Thus, compensation W has to be higher for the loss-averse plaintiff to bring a lawsuit.

3 Comparative statics

We now go over some of the comparative statics. We first examine what happens when trial costs change before looking at the role of the underlying uncertainty about the winner of a trial (distribution of p). Ultimately, we are interested in characterizing the effects on litigation costs. From the point of view of economic welfare, there is no reason for having a narrow concern for litigation costs as deterrence and precedent-setting certainly have social value. However, given their high administrative costs, judicial systems often try to foster alternative dispute resolution mechanisms. It is therefore of interest to look at litigation costs.

3.1 Litigation costs

3.1.1 Plaintiff's litigation costs C_p

When the credibility constraint is not binding, an increase in C_p leads to a lower probability of trial. Higher C_p means larger losses, so the effect of loss aversion is bigger. The plaintiff thus prefers a higher settlement probability to avoid the loss. The net effect on total litigation costs is ambiguous.

When the credibility constraint is binding, an increase in C_p leads to a higher probability of trial because the plaintiff has to further increase the offer amount to keep her threat to proceed to trial credible. Thus, contrary to the standard model, such an increase in the plaintiff's litigation costs might decrease the probability of settlement due to the credibility constraint. If C_p becomes too high for the plaintiff to profit from litigation, the probability of trial drops to zero, as the lawsuit is simply not introduced. The following figure gives an illustration:

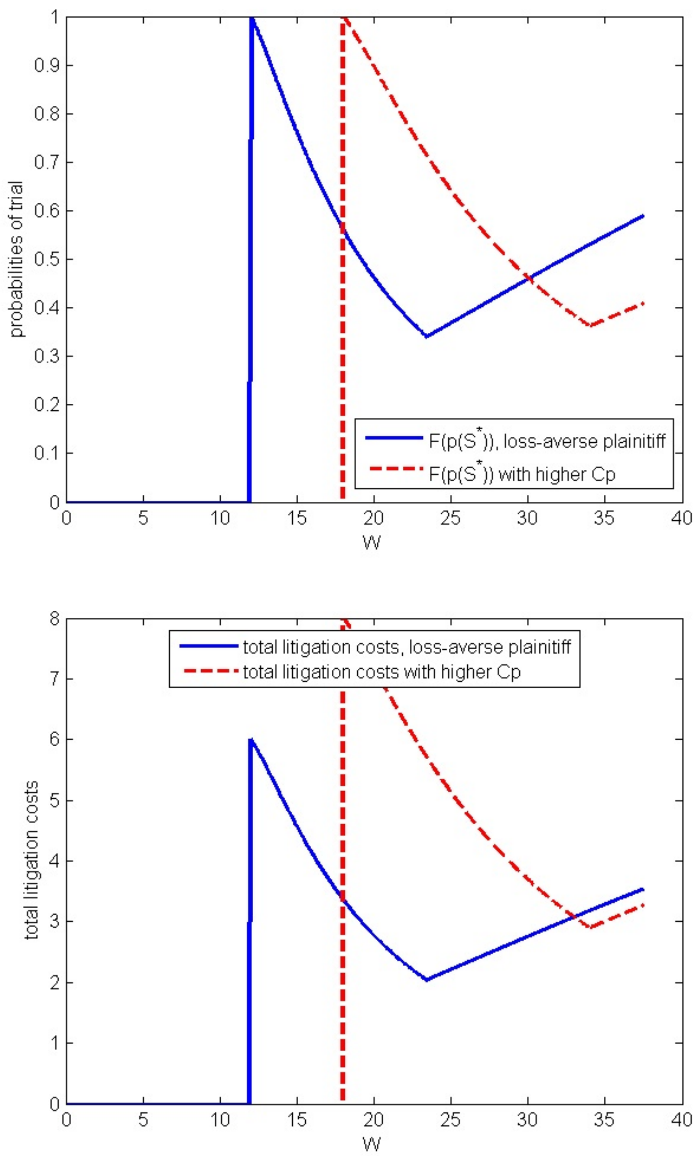

Figure 4. The effect of higher C_p on trial probabilities and on litigation costs (the shift is from $C_p = 2$ to $C_p = 4$, and other parameters are the same as before)

3.1.2 Defendant's litigation costs C_d

The effects of higher C_d also depend on W. When W is low and the credibility constraint is binding, C_d does not affect the plaintiff's choice of $p(S^*)$. It is determined by equation (6), $U_p^{trial}(S^*) = 0$, and C_d plays no part in it. S^* increases as C_d does just to keep $p(S^*)$ unchanged and equation (6) satisfied.

If W is high enough such that the credibility constraint is not binding, an increase in C_d lowers $p(S^*)$ as the marginal benefit of settlement becomes higher for the plaintiff from first-order condition (5). It translates into a lower probability of trial. However, when trial takes place, litigation costs are higher because C_d is higher. The effects on S^* and total litigation costs are ambiguous.

The following figures give an illustration:

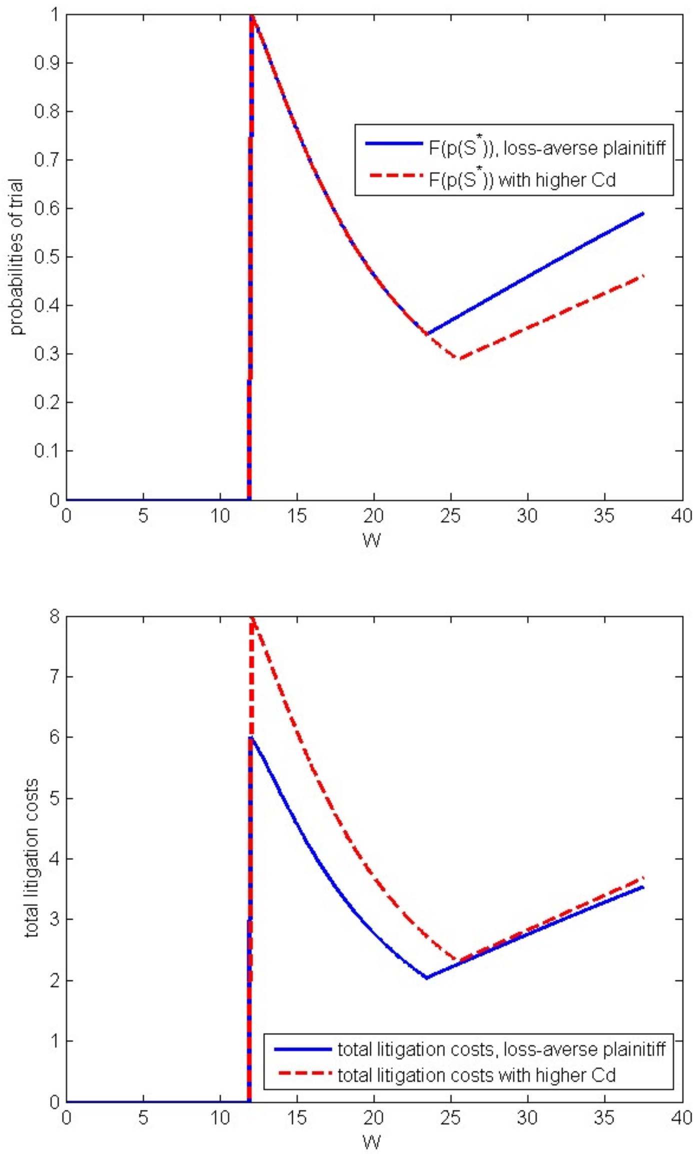

Figure 5. The effect of higher C_d on trial probabilities and on litigation costs (the shift is from $C_d = 2$ to $C_d = 4$, and other parameters are the same as before)

3.2 Distribution of p

In this subsection, we modify the assumption that the support of p is $[0, 1]$. Instead, we assume the support to be $[\underline{p}, \bar{p}]$ with $\underline{p} > 0$ and $\bar{p} < 1$. We consider two distributional changes regarding p.

First, we consider a shift to distribution $G(\cdot)$ in support $[\underline{p} + \varepsilon,\ \bar{p} + \varepsilon]$ with $g(x + \varepsilon) = f(x)$ for $x \in [\underline{p}, \bar{p}]$. The new distribution $G(\cdot)$ first-order stochastically dominates distribution $F(\cdot)$, which means that the plaintiff unambiguously faces a pool of weaker defendants.

Under the new distribution $G(\cdot)$, the plaintiff's credibility constraint is less restrictive as the overall winning probability is higher. It translates into a lower settlement offer and a lower probability of trial. When the credibility constraint is not binding, the loss-neutral plaintiff asks for a higher settlement offer but the probability of trial stays the same (first-order condition (5′)). However, for the loss-averse plaintiff, the probability of trial will increase under distribution $G(\cdot)$. Intuitively, as the the plaintiff's overall probability of losing is lower under $G(\cdot)$, the effect of loss aversion becomes smaller and, as a result, he chooses to bargain more aggressively.

Proposition 3. *When the distribution of defendant's types switches from F to G:*

1. *$\underline{W}$ decreases;*
2. *$p(\underline{S})$ decreases;*
3. *$p(S^{foc})$ increases by more than ε;*
4. *$\tilde{W}$ decreases.*

Proof. *see the appendix* □

Thus, a loss-averse plaintiff sues for a wider range of claims, settles intermediate claims more often, but settles high claims less often. So, again, the effect on litigation costs depends on the size of the claim. The following figure gives an illustration:

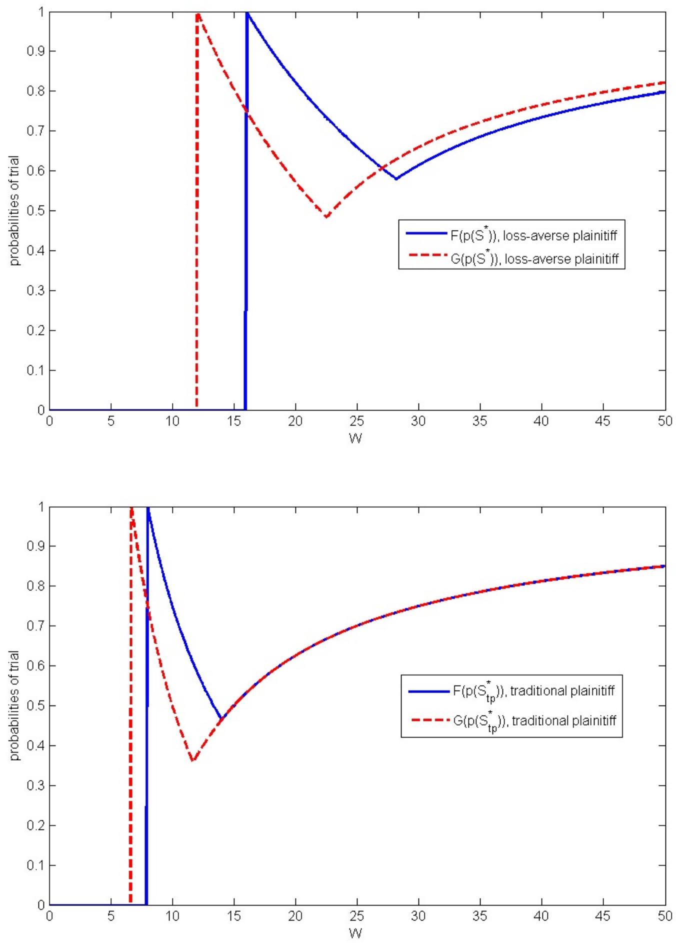

Figure 6. FOSD shift of distribution ($\mu = 2, C_p = 4, C_d = 2$)
The shift is from a truncated normal distribution with mean 0.5 and support [0.2,0.8] to a truncated normal distribution with mean 0.7 and support [0.4,1]. The untruncated distribution has standard deviation 0.2.

Second, we consider a mean-preserving truncation of $F(\cdot)$. Formally, for F with support $[\underline{p},\, \bar{p}] \subset [0,\, 1]$ and for a small $\varepsilon > 0$, define $\underline{p}' = \underline{p} + \varepsilon$ and $\bar{p}' < \bar{p}$ such that $\mathbb{E}[p] = \mathbb{E}[p|p \in [\underline{p}',\, \bar{p}']]$. (Such a $\bar{p}'$ can always be found.) Take $\tilde{G}$ to be the truncation of F on $[\underline{p}',\, \bar{p}']$. Then, $\tilde{G}$ is a mean-preserving truncation of F and second-order stochastically dominates F. Such a change captures a reduction in the degree of information asymmetry between the two parties (leaving the average odds unchanged). In practice, it means "extreme" cases are eliminated from the distribution.

Proposition 4. *When the distribution of defendant's types switches from F to a mean-preserving truncation $\tilde{G}$:*

1. *$\underline{W}$ is not affected;*

2. *$p(\underline{S})$ decreases;*

3. $p(S^{foc})$ *decreases.*

Proof. *see the appendix* □

This result is similar to the one in Bebchuk (1984): the effect on S^* is ambiguous but the probability of trial is for sure lower. A mean-preserving truncation of the distribution of p means that the plaintiff has more precise information about the defendant's type. Therefore, a mutually beneficial settlement becomes more likely.

The following figure gives an illustration:

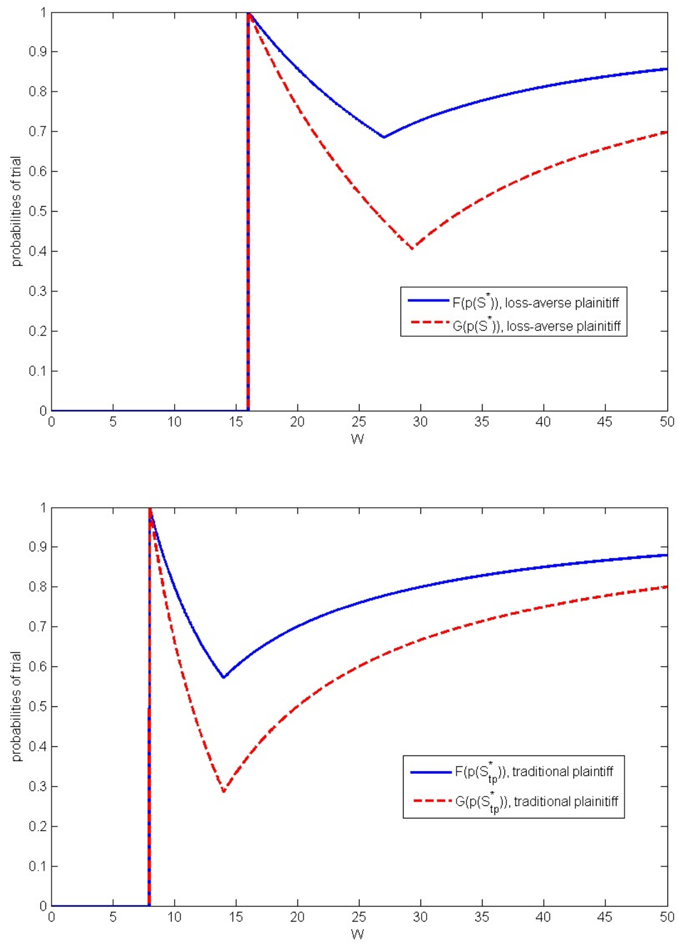

Figure 7. mean preserving truncation of distribution $(\mu = 2, C_p = 4, C_d = 2)$
The shift is from a truncated normal distribution with mean 0.5 and support [0,1] to a truncated normal distribution with mean 0.5 and support [0.1,0.9]. The untruncated distribution has standard deviation 0.2.

4 Extensions: fostering settlements

Imagine again that society considers total trial costs to be of concern. What can it do to reduce the volume and costs of trials? Procedural rules about the allocation of trial costs or other ways to foster settlements have been extensively discussed in the literature. In our model, what happens when some of those rules are implemented?

4.1 Fee-shifting rules

In the baseline model, we assumed that the court enforced the so-called American rule in the allocation of litigation costs: each party pays for their own legal expenses regardless of the trial outcome. Now, we consider the English rule, which provides that the loser in court pays for both parties' litigation costs. It is equivalent to moving to an environment with $W^{EN} = W + C_p + C_d$, $C_p^{EN} = C_p + C_d$ and $C_d^{EN} = 0$ under the American rule. In practice, the English rule amounts to raising the stakes for the plaintiff both on the income and the cost sides. Fee-shifting has been extensively studied, theoretically, experimentally and econometrically.[13]

For intermediate claims where the credibility constraint is binding, shifting to the English rule has ambiguous effects. In the American rule, $\underline{W}$, the lowest compensation that incentivizes the plaintiff to sue is:

$$\underline{W} \;=\; [1 + (\mu - 1)(1 - \mathbb{E}[p])] \frac{C_p}{\mathbb{E}[p]}$$

Under the English rule, we have:

$$\underline{W}^{\mathrm{EN}} \;=\; \frac{\mu(1 - \mathbb{E}[p])}{\mathbb{E}[p]}(C_p + C_d)$$

The relative size of $\underline{W}$ and $\underline{W}^{\mathrm{EN}}$ depends on μ, C_p, C_d as well as the unconditional expectation of p.

If the credibility constraint is not binding, the likelihood of settlement is lower under the English rule if the plaintiff is not loss-averse (Bebchuk 1984). With loss aversion, the fee-shifting may have ambiguous effects: if the level of loss-aversion is high for the plaintiff, then the English rule may encourage settlement. From the first-order condition (5), we have the following comparison:

$$\frac{1 - F(p(S^{foc}))}{f(p(S^{foc}))} \;=\; \frac{(C_p + C_d)}{W} + (\mu - 1)\,(1 - p(S^{foc}))\,\frac{C_p}{W} \tag{5}$$

$$\frac{1 - F(p(S^{foc}_{\mathrm{EN}}))}{f(p(S^{foc}_{\mathrm{EN}}))} \;=\; \frac{(C_p + C_d)}{W + C_p + C_d} + (\mu - 1)\,(1 - p(S^{foc}_{\mathrm{EN}}))\,\frac{C_p + C_d}{W + C_p + C_d} \tag{5$^{\mathrm{EN}}$}$$

For $\mu = 1$, fee-shifting unambiguously decreases the right side of equation (5). From the increasing hazard rate property, $p(S^{foc})$ increases as a result, leading to a lower settlement rates. For equation (5^{EN}), the right-hand side might become smaller if μ and C_d are large. Intuitively, if the heavy cost is shifted to the plaintiff and the effect of loss aversion is large, then the plaintiff might prefer settling with a higher probability. The following figure illustrates such a possibility:

13. See Kritzer (2001), Spier (2007) or Helmers et al. (2019) for reviews of the literature.

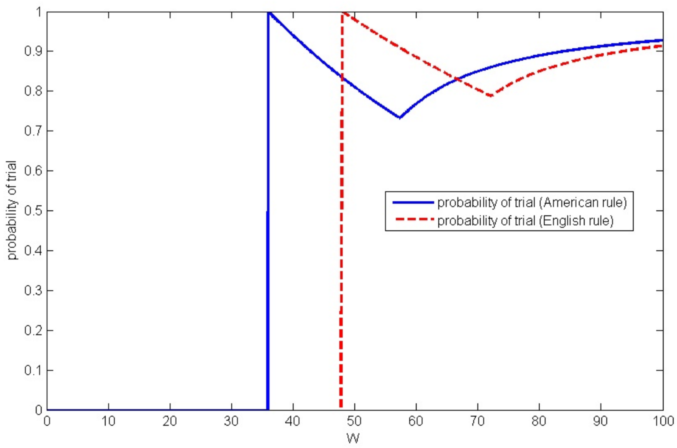

Figure 8. probabilities of trial under different rules ($\mu = 2, C_p = 4, C_d = 2$)

Obviously, the net effect on the total number of trials will depend on the distribution of W. However, a decrease in the number of trials is possible. This finding is important, because some of the available experimental or empirical evidence about the impact of fee-shifting (Anderson and Rowe, 1995; Hugues and Snyder, 1995; Kritzer, 2001, Helmers et al., 2019) reports an *increase* in settlement rates upon the adoption of the English rule, which our model rationalizes, contrary to Bebchuck's (1984).

4.2 An in-court settlement regime

From Proposition 2, we can see that the plaintiff's binding credibility constraint leads to a higher offer amount and thus higher probabilities of trial for medium-range claims. The constraint results from the plaintiff's lack of commitment power. If the plaintiff could credibly commit to trial in case her offer is rejected, then she as well as the defendant would benefit: she would be able to make a lower settlement offer that suits herself better. To achieve this, one may think of moving from the out-of-court settlement regime which we have studied so far to an in-court settlement regime.

Suppose indeed that the legal system does not allow a plaintiff to drop a suit outside court. Then, even a settlement necessitates to go, and pay, for trial. In an (extreme) in-court settlement regime, the plaintiff pays C_p at the time she introduces the lawsuit: she will use the court's and her lawyer's services even if she settles with the defendant as this has to be agreed by the court. This will remove the credibility constraint. The loss-averse plaintiff chooses S to maximize the following:

$$U_p^{\text{in-court}}(S) \;=\; [1 - F(p(S))](S - C_p) + \int_0^{p(S)} [p\,(W - C_p) - (\mu - 1)(1 - p)C_p]\, f(p) dp \qquad (8)$$

The optimal settlement offer (S_{in}^*) is characterized by the following first-order condition:

$$\frac{1 - F(p(S_{in}^*))}{f(p(S_{in}^*))} \;=\; \frac{C_d}{W} + (\mu - 1)\,(1 - p(S_{in}^*))\,\frac{C_p}{W} \qquad (5^{\text{in-court}})$$

Our assumptions on $F(\cdot)$ guarantees that we have a unique interior solution $S_{in}^* \in [C_d, W + C_d)$. It is straightforward to show that $S_{in}^* > S^{foc}$: C_p has been paid up-front so saving C_p is no longer an advantage associated to settlement, compared to trial. The credibility constraint no longer plays a role because giving up trial means a sure loss of C_p. Therefore, for intermediate values of W at which the credibility constraint is binding in the out-of-court settlement regime, we may have $S_{in}^* < S^*$ for the loss-averse plaintiff.

For the lowest W that incentivizes a loss-averse plaintiff to sue ($\underline{W_{in}}$), we have $\underline{W_{in}} \leqslant \underline{W}$. Intuitively, at $W = \underline{W}$ in the in-court settlement system, the plaintiff could bring the lawsuit and ask for $S \geqslant W + C_d$. This brings her the same utility as in the out-of-court settlement regime. It is possible that she can do better because the credibility constraint is no longer playing a role.

A special case is when $C_d \geqslant C_p$. The plaintiff can bring the lawsuit, pay C_p and ask for $S = C_d$ as long as $W \geqslant 0$. The defendant will accept the offer whatever his type is. We have $\underline{W_{in}} \leqslant \underline{W}$ in general and $\underline{W_{in}} \leqslant 0$ if $C_d \geqslant C_p$: under the in-court settlement regime, the loss-averse plaintiff brings more small-claim lawsuits and sometime even lawsuits with negative expected values. Cases with negative expected value become profitable in the in-court settlement regime, provided the defendant's costs are high enough. That is consistent with the results in Bebchuk (1996). The following figure gives an illustration for $C_d \geqslant C_p$ cases.

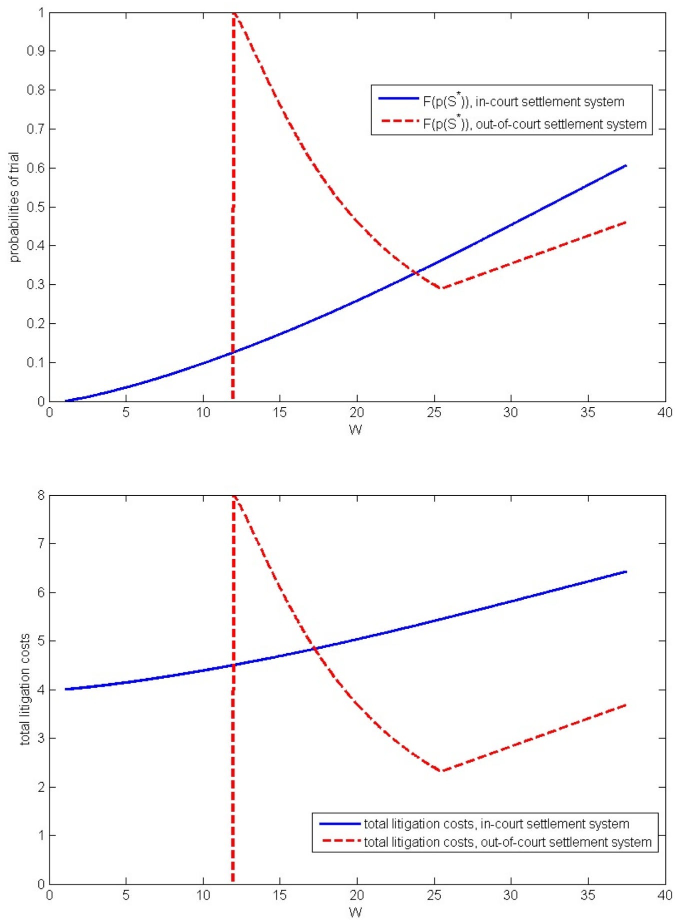

Figure 9. probabilities of trial and litigation costs under different settlement systems ($\mu = 2, C_p = 4, C_d = 2$)

Thus, the effect of requiring the plaintiff to settle in-court (at a cost) would have an ambiguous effect on the volume of litigation: the net effect would again depend on the distribution of claims.

5 Concluding Remarks

Our goal in this paper was to show how loss aversion theoretically affects people's behavior in (civil) litigation, in particular with regards to settlements. We have shown how loss aversion might lead to fewer suits for small claims, a lower settlement probability for medium claims, and a higher settlement probability for large claims. Due to loss aversion's effect on the plaintiff's credibility constraint, policies aiming at reducing the number of costly trials and at fostering settlements may have different effects for claims of different sizes. The only change in the modeled environment which unambiguously leads to fewer trials across the board is the reduction in the degree of information asymmetry about trial odds. Thus, rules and policies that encourage access to informed legal advice or discovery at an early stage seem to be the best way to foster settlements.[14]

In our analysis, we assumed that both litigants are risk-neutral. Risk aversion and loss aversion are similar in one respect: the decision-maker puts extra weight on the worst outcomes. Some of the results we have analyzed would materialize if the parties to a dispute were risk-averse instead of loss-averse. There are differences, however, due to the fact that risk aversion would affect the behavior of the defendant, by making him more generally amenable to a settlement.

If we include the prospect theory insight that people are risk-averse in the gain domain and risk-loving in the loss domain, then it will become more difficult for the litigants to reach a settlement. For one, risk aversion makes it harder for the plaintiff to commit to trial and will tighten the credibility constraint. Second, in the loss domain, risk loving makes the defendant more willing to accept the gamble of a trial and less willing to accept a settlement.

In any case, a more realistic specification of preferences in the presence of asymmetric information can help explain why we observe fewer settlements, especially for small claims, than the conventional model predicts.

14. Waldfogel (1998) and Huang (2009) provide some evidence to this effect.

Appendix

Proof. Lemma 1
In the proper sub-game after the plaintiff makes offer S, if a defendant with type p chooses $r(S,p)<1$, then his expected payment is positive: $(1-r)\,S$. If he switches to rejecting for sure, his expected payment is 0 since the plaintiff drops the suit with probability 1 following rejection. Hence, all types should reject offer S. □

Proof. Lemma 2
In the proper sub-game after the plaintiff makes offer S, by assumption the defendant expects the plaintiff to pursue the case with some positive probability if he rejects the offer $(d^r(S)\in[0,1))$. The defendant will compare the outcome of accepting the offer and that of rejecting it. For a defendant with type p, the expected utility from rejecting the offer is (subscript d stands for defendant):

$$U_d^{trial}(p) = -(1-d^r(S))\,(p\,W + C_d)$$

The expected utility from accepting the offer is $-S$. As $U_d^{trial}(p)$ is decreasing in p, $U_d^{trial}(\tilde{p}) \geqslant -S$ implies that $U_d^{trial}(p) > -S$ for $p<\tilde{p}$ and $U_d^{trial}(\tilde{p}) > -\tilde{S}$ for $\tilde{S} > S$. □

Proof. Proposition 1 the existence and uniqueness of S^{foc}

The first order condition (5) could be written as:

$$\frac{1-F(p(S^{foc}))}{f(p(S^{foc}))} = \frac{(C_p + C_d)}{W} + (\mu-1)\,(1-p(S^{foc}))\,\frac{C_p}{W}$$

Define function $H(\cdot)$ as the following:

$$\begin{aligned} H(x) &\equiv \frac{(C_p + C_d)}{W} + (\mu-1)\,(1-x)\,\frac{C_p}{W} - \frac{1-F(x)}{f(x)}, \qquad x\in[0,1] \\ &= \frac{(\mu C_p + C_d)}{W} - (\mu-1)x\,\frac{C_p}{W} - \frac{1-F(x)}{f(x)} \end{aligned}$$

$H(x)$ is continuous and twice differentiable by our assumptions. We have:

$$\begin{aligned} H(1) &= \frac{(\mu C_p + C_d)}{W} - (\mu-1)\,\frac{C_p}{W} = \frac{(C_p + C_d)}{W} > 0 \\ H(0) &= \frac{(\mu C_p + C_d)}{W} - \frac{1}{f(0)} < 0 \qquad \text{by assumption 1} \end{aligned}$$

It means that $H(x)=0$ has at least one solution at $[0,1]$. For the solution to be unique, a sufficient condition is that the second-order derivative of function $H(\cdot)$ has a constant sign over $[0,1]$. Because the loss-aversion part $-(\mu-1)x\,\frac{C_p}{W}$ is linear in x, the condition is met if and only if the second-order derivative of the reversed hazard rate function $\frac{1-F(x)}{f(x)}$ has a constant sign over $[0,1]$, which is our assumption 3. The uniqueness is established in the following manner:

Under the three assumptions 1) $H(0)<0$; 2) $\frac{1-F(x)}{f(x)}$ is decreasing in p on $[0,1]$; and 3) the second-order derivative of $\frac{1-F(x)}{f(x)}$ has a constant sign on $[0, 1]$, the function $H(x)$ has three possible curvatures over $[0,1]$: 1) monotonically increasing; 2) increasing in $[0, \hat{x}]$ and decreasing in $(\hat{x}, 1]$ where $\hat{x}\in[0, 1]$ and $H'(\hat{x}) = 0$; 3) decreasing in $[0,\tilde{x}]$ and increasing in $(\tilde{x},1]$ where $\tilde{x}\in[0,1]$ and $H'(\tilde{x})=0$.

In form 1), we can directly apply the intermediate value theorem on [0, 1]. With monotonicity, it is clear that a unique root exists. In form 2) we can apply intermediate value theorem on $[0, \hat{x}]$ and in form 3) on $[\tilde{x}, 1]$. With monotonicity, a unique root is also guaranteed. The corresponding settlement offer S can be recovered from the root $p(S)$. □

Proof of Proposition 2:

The loss-averse plaintiff's trial stage utility is:

$$U_p^{trial}(S) = \mathbb{E}\left[p|p < p(S)\right] W - C_p - (\mu - 1)\left(1 - \mathbb{E}\left[p|p < p(S)\right]\right) C_p$$

We have $d\,U_p^{trial} / d\,p(S) > 0$. And since $d\,p(S) / d\,S \geqslant 0$, we have $dU_p^{trial} / dS \geqslant 0$. This means the maximum of U_p^{trial} is achieved at $p(S) = 1$ and $S \geqslant W + C_d$ for any given W. We use $\overline{U_p^{trial}}$ to denote this maximum:

$$\overline{U_p^{trial}} = E[p]\, W - C_p - (\mu - 1)\,(1 - E[p])\, C_p$$

We also have that $d\,U_p^{trial} / d\,W > 0$. By definition of $\underline{W}$, $\overline{U_p^{trial}} = E[p]\underline{W} - C_p - (\mu - 1)\,(1 - E[p])\, C_p = 0$. So, for $W < \underline{W}$, $U_p^{trial}(S) < 0$ for any S. Hence, the credibility constraint cannot be met and the plaintiff will drop the suit for sure if a settlement offer is rejected. By Lemma 1, all types of defendants reject the offer. Therefore, the loss-averse plaintiff will not bring the lawsuit. A similar proof goes for the traditional plaintiff for $W < \underline{W_{tp}}$. As $\underline{W_{tp}} = \frac{C_p}{\mathbb{E}[p]} < \underline{W}$, a loss-averse plaintiff does not file a lawsuit while a traditional plaintiff does for $W \in [\underline{W_{tp}}, W)$. This proves part 1.

To prove parts 2 and 3, we state the following two lemmas.

Lemma 3. $\underline{S} > \underline{S_{tp}}$*;* $S^{foc} < S_{tp}^{foc}$*.*

Proof. The proof of this lemma directly follows the definition of the relevant settlement offers. For $\underline{S}$ and $\underline{S_{tp}}$, we have:

$$\mathbb{E}[p|p < p(\underline{S})]\, W - C_p \;=\; (\mu - 1)\,(1 - \mathbb{E}[p|p < p(\underline{S})])\, C_p \tag{6}$$

$$\mathbb{E}[p|p < p(\underline{S_{tp}})]\, W - C_p \;=\; 0 \tag{6'}$$

As $\mu > 1$ and $\mathbb{E}\left[p|p < x\right]$ is weakly increasing in $x \in [0, 1]$, we have $\underline{S} > \underline{S_{tp}}$. Moreover, $\underline{S}(W)$ and $\underline{S_{tp}}(W)$ are implicitly defined from the above equations. By the implicit functions theorem, they are both continuous functions.

For S^{foc} and S_{tp}^{foc}, using $p'(S) = 1 / W$, we have

$$\begin{aligned} 1 - F(p(S^{foc})) \;&=\; f(p(S^{foc}))\,(C_p + C_d) / W \\ &\quad + (\mu - 1)\, f(p(S^{foc}))\,(1 - p(S^{foc}))\, C_p / W \end{aligned} \tag{5}$$

$$1 - F(p(S_{tp}^{foc})) \;=\; f(p(S_{tp}^{foc}))\,(C_p + C_d) / W \tag{5'}$$

Similarly, $S^{foc}(W)$ and $S_{tp}^{foc}(W)$ are implicitly defined from the above first-order conditions (5) and (5′) and they are thus continuous functions of W. To see that S^{foc} is smaller, we check what happens on the margin if the loss-averse plaintiff chooses S_{tp}^{foc} instead. The first-order derivative becomes:

$$U_p'(S_{tp}^{foc}) = -(\mu - 1)\, f(p(S_{tp}^{foc}))\,(1 - p(S_{tp}^{foc}))\, C_p / W < 0$$

Therefore, $S^{foc} < S^{foc}_{tp}$. □

To continue with the proof, we define two more critical values of W. For the loss-averse plaintiff, $\widetilde{W_p}$ is defined as in $S^{foc}(\widetilde{W_p}) = \underline{S}(\widetilde{W_p})$; for the traditional plaintiff, $\widetilde{W_{tp}}$ is defined in $S^{foc}_{tp}(\widetilde{W_{tp}}) = \underline{S_{tp}}(\widetilde{W_{tp}})$. $\widetilde{W_p}$ ($\widetilde{W_{tp}}$) is the lowest compensation at which the constraint $U^{trial}_p(S) \geqslant 0$ ($U^{trial}_{tp}(S) \geqslant 0$) is slack for the loss-averse (traditional) plaintiff.

To see that $\widetilde{W_p}$ is uniquely defined, we use the fact that for $W \geqslant \underline{W}$, we have:

$$d\,p(S^{foc})\,/\,d\,W > 0, d\,p(\underline{S})\,/\,d\,W < 0$$

At $W = \underline{W}$, an equilibrium offer cannot be lower than $W + C_d$ due to the credibility constraint: we have $p(\underline{S}) = 1 > p(S^{foc})$.[15] For $W \to \infty$, $p(\underline{S}) \to 0$ and $p(S^{foc}) \to 1$. From the intermediate value theorem, we can find $\widetilde{W_p}$ such that $p(S^{foc}) = p(\underline{S})$ and $S^{foc}(\widetilde{W_p}) = \underline{S}(\widetilde{W_p})$. A similar proof goes for the traditional plaintiff. At $W = \widetilde{W_{tp}}$, we have $S^{foc}_{tp}(\widetilde{W_{tp}}) = \underline{S_{tp}}(\widetilde{W_{tp}})$.

Lemma 4. *At* $W = \widetilde{W_{tp}}$, $p(S^*) > p(S^*_{tp})$ *and* $S^* > S^*_{tp}$; *for* $W > \widetilde{W_{tp}}$, $S^*_{tp} = S^{foc}_{tp}$. *For* $W \in [\underline{W_{tp}}, \widetilde{W_{tp}}]$, *the* $U^{trial}_{tp}(S) \geqslant 0$ *constraint is binding for the traditional plaintiff.*

At $W = \widetilde{W_p}$, $p(S^*) < p(S^*_{tp})$ *and* $S^* < S^*_{tp}$; *for* $W > \widetilde{W_p}$, $S^* = S^{foc}$. *For* $W \in [\underline{W}, \widetilde{W_p}]$, *the* $U^{trial}_p(S) \geqslant 0$ *constraint is binding for the loss-averse plaintiff.*

$\widetilde{W_{tp}} < \widetilde{W_p}$.

Proof. At $W = \widetilde{W_{tp}}$, $S^*_{tp} = \underline{S_{tp}} = S^{foc}_{tp}$ (definition of $\widetilde{W_{tp}}$). By Lemma 3, we have $\underline{S} > \underline{S_{tp}} = S^{foc}_{tp} > S^{foc}$. Therefore, $S^* > S^*_{tp}$ and $p(S^*) > p(S^*_{tp})$.

At $W = \tilde{W}_p$, $S^* = \underline{S} = S^{foc}$ (definition of $\tilde{W}_p$). By Lemma 3, we have $\underline{S_{tp}} < \underline{S} = S^{foc} < S^{foc}_{tp}$. Therefore, $S^* < S^*_{tp}$, and $p(S^*) > p(S^*_{tp})$.

Since $S^{foc}_{tp} > \underline{S_{tp}}$ at $\widetilde{W_p}$ and $S^{foc}_{tp} = \underline{S_{tp}}$ at $\widetilde{W_{tp}}$, it means the credibility constraint is binding at $\widetilde{W_{tp}}$ but not binding at $\widetilde{W_p}$. We have $\widetilde{W_{tp}} < \widetilde{W_p}$. □

Directly from Lemma 3 and Lemma 4 , for $\underline{W} \leqslant W < \widetilde{W_{tp}}$, the credibility constraint is binding for both plaintiffs. We have $S^* = \underline{S}$, $S^*_{tp} = \underline{S_{tp}}$, $\underline{S} > \underline{S_{tp}} \Longrightarrow S^* > S^*_{tp}$; for $W > \widetilde{W_p}$, neither is binding and we have $S^* = S^{foc}$, $S^*_{tp} = S^{foc}_{tp}$, $S^{foc} < S^{foc}_{tp} \Longrightarrow S^* < S^*_{tp}$.

Now we show that in interval $[\widetilde{W_{tp}}, \widetilde{W_p}]$, there exist $\tilde{W}$ such that two plaintiffs make the same settlement offer. By Lemma 4, for $W \in [\widetilde{W_{tp}}, \widetilde{W_p}]$, we have $S^*_{tp} = S^{foc}_{tp}$, $S^* = \underline{S}$ and thus $p(S^*) = p(\underline{S})$ and $p(S^*_{tp}) = p(S^{foc}_{tp})$.

15. For $W = \underline{W}$, the plaintiff's expected utility from bringing the lawsuit and making a credible offer is zero. She is indifferent between bringing it and not. For simplicity, we assume that she brings the lawsuit, makes a credible offer and pursue the case to trial. We assume the same thing for traditional plaintiff for $W = \underline{W_{tp}}$.

At $W = \widetilde{W_{tp}}$, $p(S^*_{tp}) < p(S^*)$; at $\widetilde{W_p}$, $p(S^*_{tp}) > p(S^*)$. By the implicit function theorem, $p(S^*_{tp})$ and $p(S^*)$ are continuous in $W \in [\widetilde{W_{tp}}, \widetilde{W_p}]$ and we have the following monotonicity results from (5′) and (6):

$$\begin{aligned} d\,p(S^{foc}_{tp})/d\,W &> 0 \\ d\,p(\underline{S})/d\,W &< 0 \end{aligned}$$

From the intermediate value theorem, $p(S^*)$ and $p(S^*_{tp})$ intersect at a unique point in $(\widetilde{W_{tp}}, \widetilde{W_p})$. We use $\tilde{W}$ to denote this intersection. At $\tilde{W}$, we have $\underline{S} = S^* = S^*_{tp} = S^{foc}_{tp}$. The loss-averse plaintiff's credibility constraint is binding while the traditional plaintiff's is not. In sum, for $\underline{W} \leqslant W < \tilde{W}$, we have:

$$S^* > S^*_{tp}, p(S^*) > p(S^*_{tp}) \ \text{ if } \ \underline{W} \leqslant W < \tilde{W}$$

Total expected litigation costs are higher if the plaintiff is loss-averse because the probability of trial is higher. For $W > \tilde{W}$, we have:

$$S^* < S^*_{tp}, p(S^*) < p(S^*_{tp})$$

Total litigation costs are smaller if the plaintiff is loss-averse.
End of proof Proposition 2.

Proof of Proposition 3.

1. $\underline{W}$ is defined by: $\underline{W} = (1 + (\mu - 1)\,(1 - \mathbb{E}[p]))\,\frac{C_p}{\mathbb{E}[p]}$. $\mathbb{E}[p]$ is higher under G since G first-order stochastically dominates F. Thus, $\underline{W}$ is lower under G.
2. $p(\underline{S})$ is the unique solution to $\mathbb{E}\,[p|p < p(\underline{S})]\,W - C_p - (\mu - 1)\,(1 - \mathbb{E}[p|p < p(\underline{S})])\,C_p = 0$. Under G, $\mathbb{E}\,[p|p < h]$ is higher for any $h > \underline{p} + \varepsilon$. Since the LHS is increasing in $\mathbb{E}\,[p|p < p(\underline{S})]$ and $E\,[p|p < p(\underline{S})]$ increases in $p(\underline{S})$, a lower $p(\underline{S})$ is needed for the equality to remain true.
3. Under F, S^{foc} is given by (5). The RHS of equation (4) decreases in $p(S)$ and $\frac{1 - G(p+\varepsilon)}{g(p+\varepsilon)} = \frac{1 - F(p)}{f(p)}$. If $p(S^{\text{foc}})$ increases by ε, we have

   $$\frac{1 - G(p(S^{foc}) + \varepsilon)}{f(p(S^{foc}) + \varepsilon)} > p'(S^{foc})\,(C_p + C_d) + (\mu - 1)\,p'(S^{foc})\,(1 - [p(S^{foc}) + \varepsilon])\,C_p$$

   for $\mu > 1$. As the inverse hazard rate of F is assumed to be decreasing, the expression can then only be met with equality with $p(S) > p(S^{foc}) + \varepsilon$.
4. It follows from 2 and 3 that $\tilde{W}$ decreases. **End of Proof.**

Proof of Proposition 4.

1. $\underline{W}$ is defined by: $\underline{W} = (1 + (\mu - 1)\,(1 - \mathbb{E}[p]))\,\frac{C_p}{\mathbb{E}[p]}$. $\mathbb{E}[p]$ is the same under $\tilde{G}$. Thus, $\underline{W}$ is not affected.
2. $p(\underline{S})$ is the unique solution to $\mathbb{E}\,[p|p < p(\underline{S})]\,W - C_p - (\mu - 1)\,(1 - \mathbb{E}\,[p|p < p(\underline{S})])\,C_p = 0$. Under $\tilde{G}$, $\mathbb{E}\,[p|p < h]$ is higher for any $h > a + \varepsilon$. Since the LHS is increasing in $E\,[p|p < p(\underline{S})]$ and $E\,[p|p < p(\underline{S})]$ increases in $p(\underline{S})$, one needs a lower $p(\underline{S})$ for the equality to remain true.

3. $p(S^{foc})$ under $\tilde{G}$ is given by $\frac{1-\tilde{G}(p(S^{foc}))}{\tilde{g}(p(S^{foc}))} = p'(S^{foc})\ (C_p + C_d) + (\mu - 1)p'(S^{foc})(1 - p(S^{foc}))\ C_p$. Now, $\tilde{g}(p) = f(p)\,/\,[F(b') - F(a')]$, $\tilde{G}(p) = 0$ for $p \in [a,\, a']$, and $\tilde{G}(p) = [F(p) - F(a')]\,/\,[F(b') - F(a')]$ for $p \in (a',\, b']$. Thus, for a given p, the LHS is lower than in (4) while the RHS is unchanged. As the RHS is decreasing in $p(S^{foc})$, it calls for a decrease in $p(S^{foc})$ for the equality to be maintained. **End of Proof.**

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